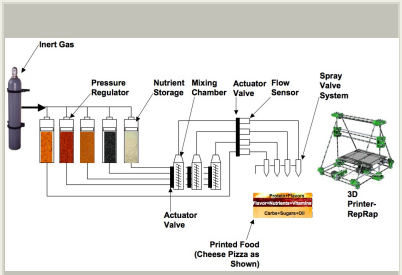
# 3D Printed Food System for Long Duration Space Missions, Phase I

Completed Technology Project (2013 - 2013)

## Project Introduction

Systems and Materials Research Corporation (SMRC) proposes combining its Manufacturing Technology and Materials Science expertise to address NASA's Advanced Food System Technology needs. Using progressive 3D printing and inkjet technologies, SMRC will design, build, and test a complete nutritional system for long duration missions beyond low earth orbit. The 3D printing component will deliver macronutrients (starch, protein, and fat), structure, and texture while the ink jet will deliver micronutrients, flavor, and smell. SMRC will team with the food science program at North Carolina State University and International Flavors and Fragrances to ensure the production of nutritious and flavorful mission supplies. SMRC proposes producing synthetic food which meets the nutritional needs of each and every mission specialist and astronaut. Using unflavored macronutrients, such as protein, starch and fat, the sustenance portion of the diet can be rapidly produced in a variety of shapes and textures directly from the 3D printer (already warm). Since basic sustenance will not ensure the long term physical and mental health of the crew, this is where the microjetting will add value. In addition to adding flavor, low volume micronutrients will be added as the food is processed by the 3D printer. The macronutrient feed stocks will be stored in dry sterile containers and fed directly to the printer. At the print head, these stocks will be combined with water or oil per a digital recipe to minimize waste and spoilage. Flavors and texture modifiers can also be added at this stage. This mixture is blended and extruded into the desired shape. The micronutrients and flavors are stored in sterile packs as liquids, aqueous solutions or dispersions. SMRC's approach not only addresses uniform long term storage, sustenance, and micro-nutrition, but also variable and changing dietary needs, variety, and boredom.

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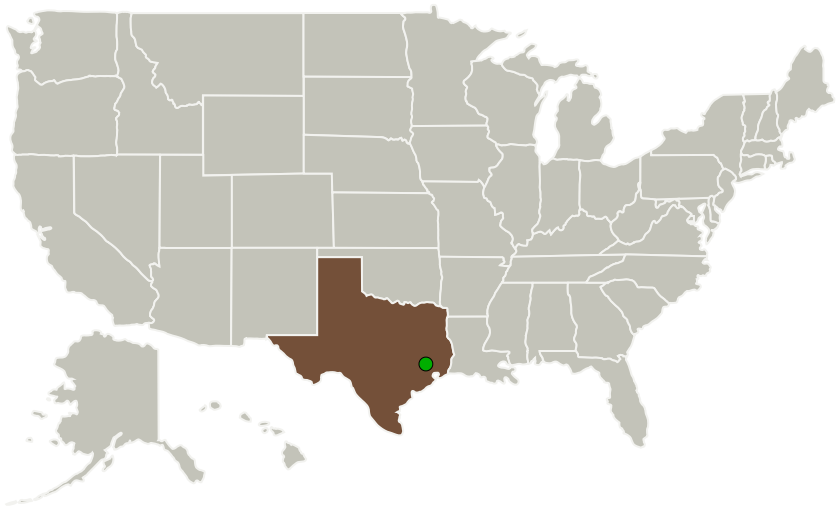
## Table of Contents

**Small Business Innovation Research/Small Business Tech Transfer**

# 3D Printed Food System for Long Duration Space Missions, Phase I

Completed Technology Project (2013 - 2013)

## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Systems & Materials Research Corporation | Lead Organization | Industry | Austin, Texas |
| Johnson Space Center(JSC) | Supporting Organization | NASA Center | Houston, Texas |

| Primary U.S. Work Locations |
|---|
| Texas |

## Project Transitions

**May 2013:** Project Start

**November 2013:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/137800)*

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Systems & Materials Research Corporation

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

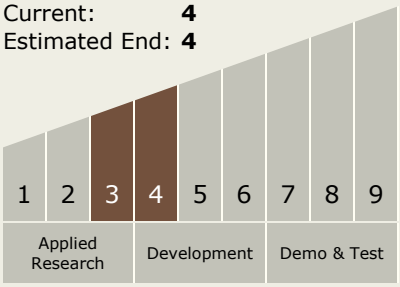
Carlos Torrez

**Principal Investigator:**

David J Irvin

## Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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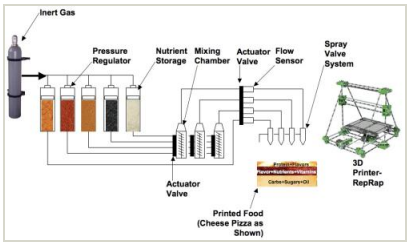
## Images




**Project Image**
3D Printed Food System for Long Duration Space Missions
*(https://techport.nasa.gov/image/136288)*

## Technology Areas

**Primary:**

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.6 Long Duration Health

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System